US Army Corps
of Engineers
North Central Division

GREAT LAKES LEVELS

Update Letter No. 93 April 1, 1993

Soo Locks at Sault Ste. Marie, Michigan

As winter ends, another navigation season is ready to begin. Nowhere in North America is this more pronounced than at Sault Ste. Marie, Michigan, where ships and other water vessels will use the Soo Locks to travel between Lake Superior and the other Great Lakes. During the 1992 season the cargo load at the Soo was 83.7 million tons, down about 5 percent from the previous year. There were a total of 11,141 passages through the locks, 4,565 of which were made by cargo vessels. The remainder were other types of vessels, such as pleasure craft, Coast guard, and scientific/research vessels.

History

The St. Marys River (Figures 1 and 2) is the only water connection between Lake Superior and the other Great Lakes. At a section of the river, known as the St. Marys Rapids, the water falls about 20 feet from the level of Lake Superior to the level of Soo Harbor. This natural barrier to navigation made necessary the construction of the project known as the St. Marys Falls Canal.

The world-famous Soo Locks form a passage for deep-draft ships around the rapids in the St. Marys River. Before Europeans

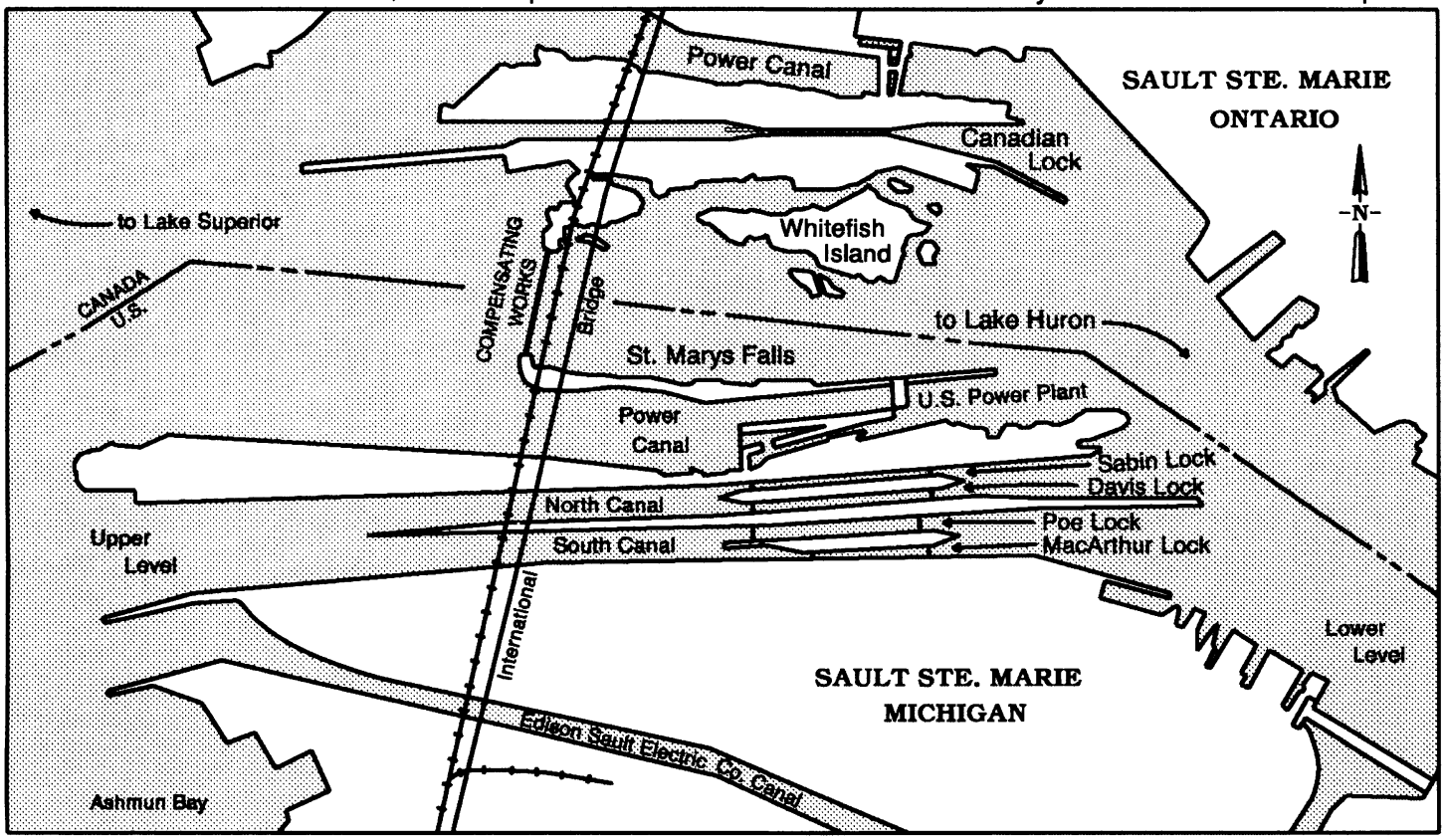


Figure 1. Locks at Sault Ste. Marie (St. Marys River)

came to the area, the Ojibway Indians, who lived nearby, portaged their canoes around the "Bawating" (rapids) to reach Lake Superior via the St. Marys River.

Early pioneers arriving in the territory were also forced to carry their canoes around the rapids. When settlement of the Northwest Territory brought increased trade and large boats, it became necessary to unload the boats, haul the cargoes around the rapids in wagons, and reload in other boats.

In 1797, the Northwest Fur Company constructed the first navigation lock on the Canadian side of the river. This lock, which was only 38 feet long, remained in use until it was destroyed in the War of 1812. Freight and boats were again forced to portage around the rapids.

In 1852, Congress passed an act granting 750,000 acres of public land to the State of Michigan as compensation to any company that would build a lock permitting waterborne commerce between Lake Superior and the other Great Lakes. The Fairbanks Scale Company, which had extensive mining interests in Michigan's upper peninsula, undertook this challenge in 1853.

In spite of many difficulties accompanying construction, Fairbanks' aggressive accountant, Charles T. Harvey, managed to build a system of two tandem locks, each 350 feet long, within the 2-year deadline set by the State of Michigan. On May 31, 1855, the locks were turned over to the state and designated as the State Locks (Figure 3).

Ships passing through the State Locks were required to pay a toll of four cents per ton until 1877, at which time the toll was reduced to three cents.

Within a few years, commerce through the canal had grown to national importance, and the need for new locks became evident. The funds required for new construction exceeded the state's capabilities, and thus, in 1881 the existing locks were transferred to

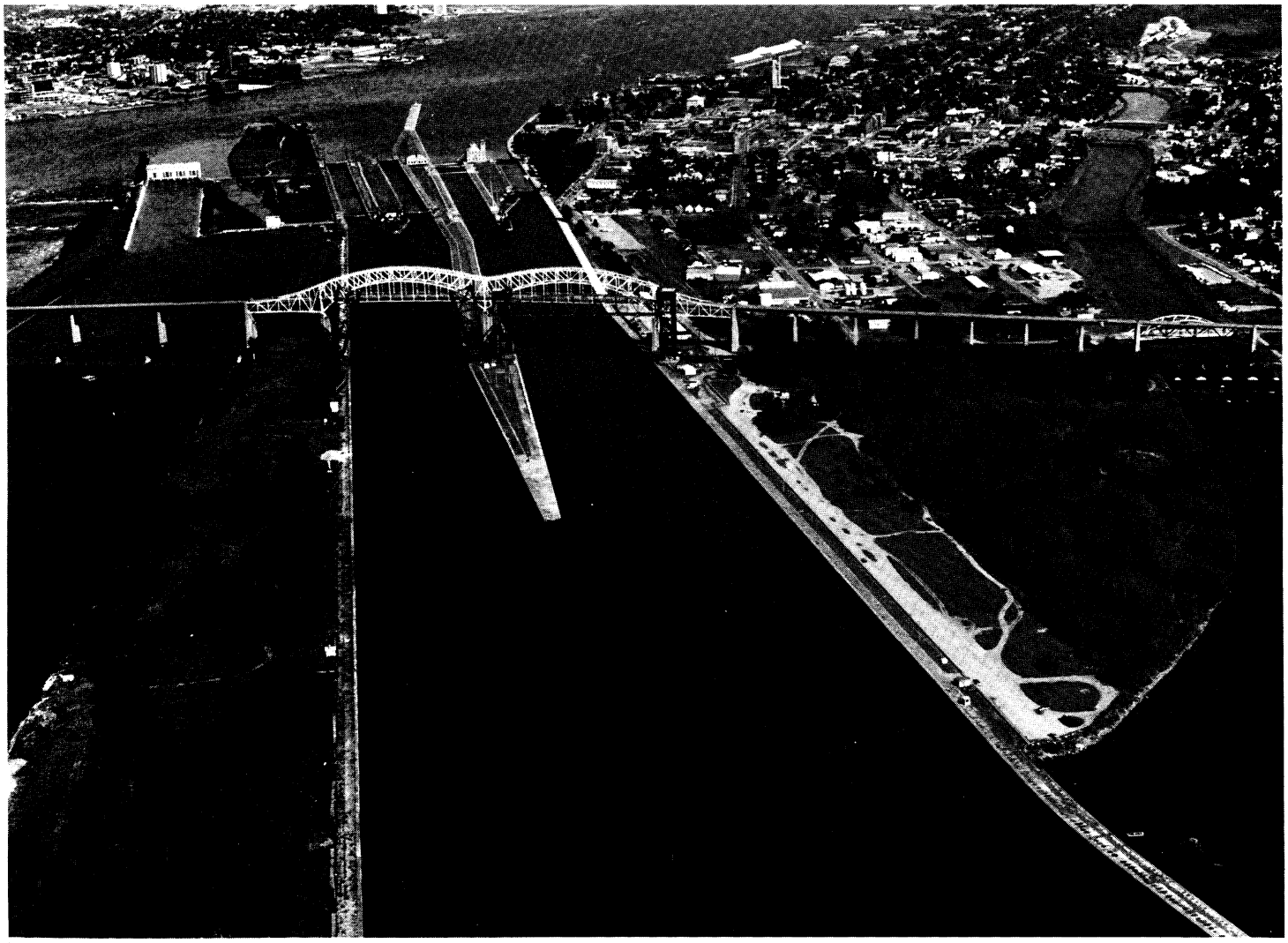


Figure 2. Panoramic View of the Soo Locks

the United States Government under the jurisdiction of the U.S. Army Corps of Engineers. The Corps has operated the locks, toll free, since that time.

Lock Facts

*The U.S. Government built a hydroelectric power plant north of the locks to generate over 150 million kilowatt hours of electricity each year. First priority for the use of the energy is for operating machinery at the Soo Locks. Any surplus energy is purchased by a private power company and is distributed to homes and businesses in Sault Ste. Marie, Michigan and surrounding communities.

*The entire facility at the St. Marys Falls Canal is operated and maintained by the Corps of Engineers, U.S. Army Engineer District, Detroit. Immediate supervision of the facility is the responsibility of the Area Engineer, Soo Area Office.

*The Poe Lock (Figure 4) has the largest capacity of the four locks. The lock, completed in 1968, took six years to build, and is the only lock ever constructed between two already operating locks. The lock was named for Orlando M. Poe, Engineer Officer during the Civil War, and twice assigned as Detroit District Engineer (1870-1873 and 1883-1895).

*The MacArthur Lock, constructed in 1943, was named for General Douglas MacArthur, most noted as Allied Commander of the Southwest Pacific Theater in World War II, of the Postwar Japanese occupation, and finally as Commander of the United Nations forces in Korea. General MacArthur, who was a Corps of Engineers Officer, also served as Superintendent at the U.S. Military Academy at West Point, New York.

*The Davis Lock, constructed in 1914, was named for Colonel Charles E. L. B. Davis, Detroit District Engineer from 1904 to 1908.

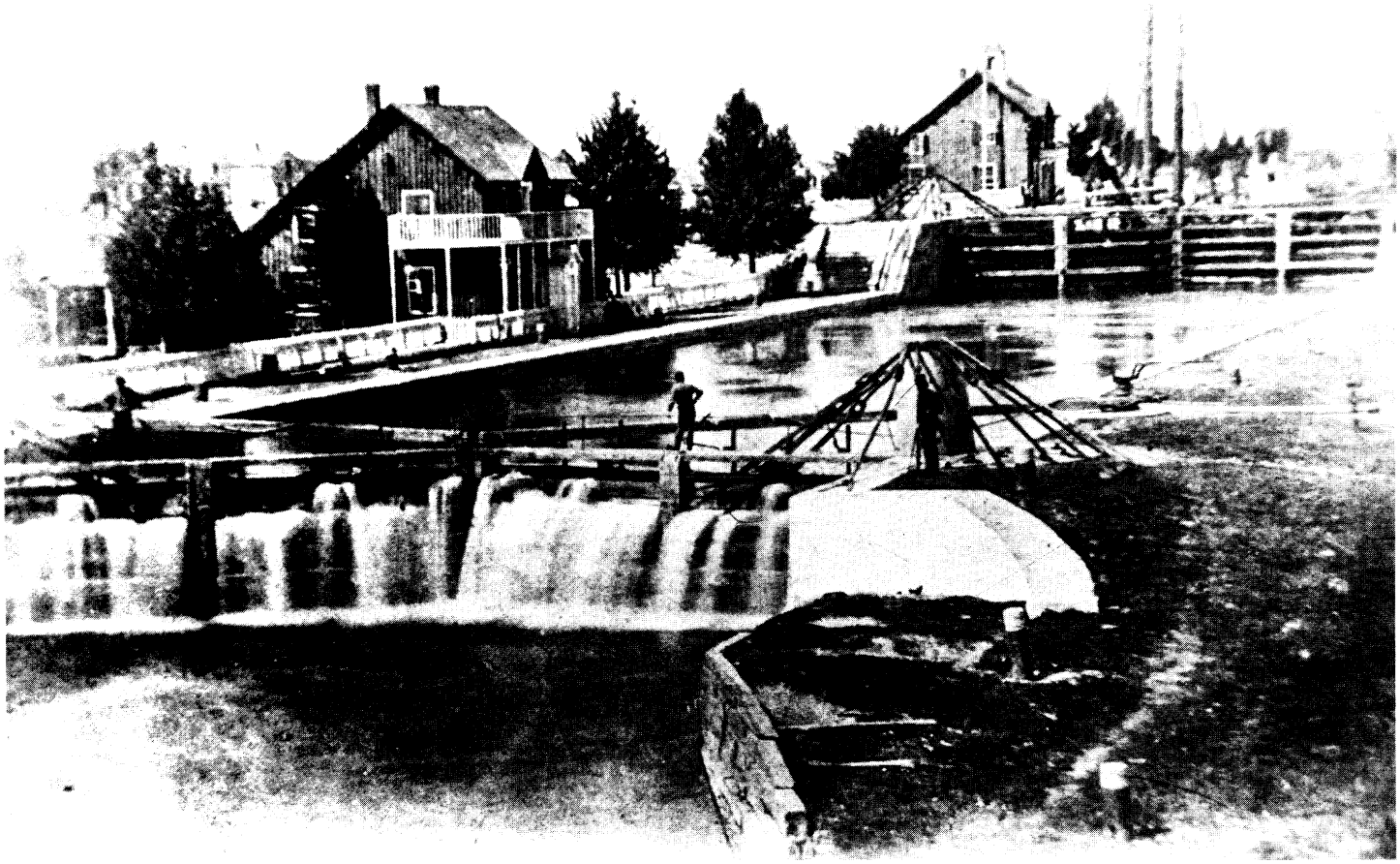


Figure 3. Old State Lock

*The Sabin Lock, which is closed, was constructed in 1919 and named for L.C. Sabin, the only civilian to serve as a Detroit District Engineer (1918-1919).

*An authorized new lock would utilize the area now occupied by the Davis and Sabin Locks. The project is awaiting sponsorship and funding.

*Inspection of the locks themselves, the culverts, and galleries is done annually to check their structural soundness. This inspection is normally done during the winter months.

*Many different types of vessels pass through the locks during a year, varying in size from small passenger vessels and work boats to large ships carrying more than 72,000 tons of freight in a single cargo. In recent years, the number of passages through the locks has averaged about 12,000 vessels per year, down from previous years due to the fact that larger vessels can carry more freight at one time.

*The navigation channels through the St. Marys River have been deepened to permit ship loading to a maximum draft of 25.5 feet at low water datum. When lake levels are above the low water datum, the larger ships load to take advantage of the deeper water at a rate of over 200 tons per inch of additional loading. Locks are a form of water elevator for raising or lowering ships from one elevation to another. This procedure is illustrated in Figure 5.

The Visitors Center

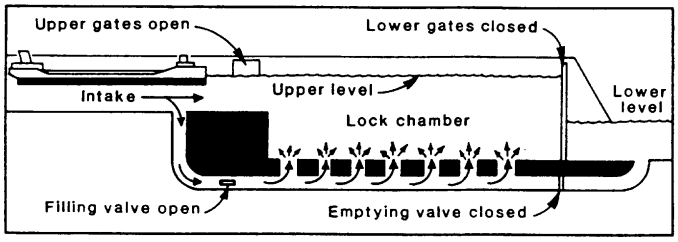
The Corps of Engineers has taken many steps to enhance the beauty of the Soo Locks and to make the locks one of the finest tourist attractions in the United States. An elevated observation platform has been erected alongside the locks and a Visitors Center is open to the public from May to November.

The Center features a number of displays as follows: working model of a lock which illustrates the entire operation; a motion picture gallery featuring a film on the history and operation of the

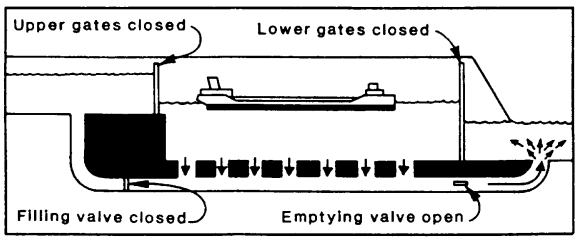
Figure 4. Stewart J. Cort, first "1000-footer" ever constructed passing downstream through the Poe Lock

How navigation locks operate

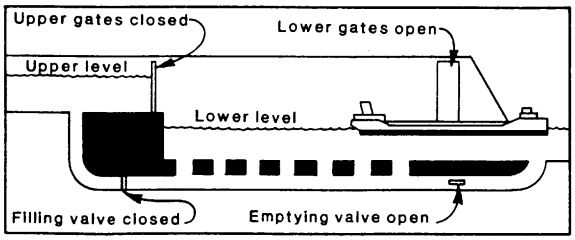
These diagrams show how a ship is lowered in a lock. A ship is raised by reversing the operation. No pumps are required; the water is merely allowed to seek its own level.



With both upper gates and lower gates closed, and with the emptying valve closed and the filling valve open, the lock chamber has been filled to the upper level. The upper gates are then opened, allowing the ship to enter the lock chamber.



Now the ship is in the lock chamber. The upper and lower gates and the filling valve are closed. The emptying valve has been opened to allow water to flow from the lock chamber to the lower level.



With the water level in the lock chamber down to the lower level, the lower gates have been opened, and the ship is leaving the lock chamber. After this, the lock is ready for an upbound ship to come in and be lifted, or may be filled to lower another downbound ship.

Vessels wishing to use the locks can reach the Chief Lockmaster on VHS-FM channel 14 (preferred) or channel 16.

Figure 5. Sketch of how locks operate.

locks; a large relief map of the Great Lakes region, as well as many other artifacts, charts, maps, and photographs of interest.

Tour guides are available at the Visitors Center during the tourist season. A public address system provides visitors information on approaching vessels preparing to use the locks. General information, such as size of the ship, destination, kind of cargo, tonnage and nationality, is also provided.

A fountain with colored lights and synchronized music is located in the park area for visitors' enjoyment during daylight and evening hours.

Additional Information

Much of the information presented herein was taken from a brochure published by the U.S. Army Corps of Engineers Detroit District. Brochures are available by writing to the Detroit District's Public Affairs Office, P.O. Box 1027, Detroit, Michigan, 48231-1027.

The Corps also has available a 25-minute 16mm film, "The Great Lakes Connection," which tells the story of the operation of the locks at Sault Ste. Marie, Michigan, emphasizing the significance of their role in waterborne commerce. This film is available from the U.S. Army Corps of Engineers on a free-loan basis, by writing Modern Talking Pictures Services, Inc., 5000 Park Street North, St. Petersburg, Florida 33709.

High Water Levels

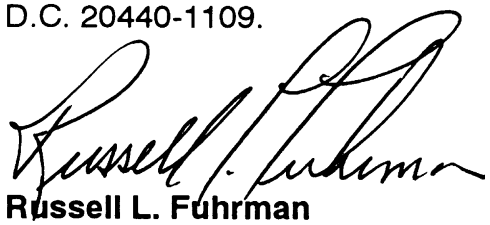
There is a continued program of increasing the outflows from Lake Ontario to alleviate the concerns of riparians as reported in the previous issue of the Update Letter. The International Joint Commission (IJC) and the International St. Lawrence River Board have been monitoring the situation of supplies and levels and alert warnings were issued to the public.

IJC Great Lakes Levels Reference Study

The final phase of the IJC Levels Reference Study concluded on 31 March 1993 with the submission of the Study Board's report to the IJC offices in Washington and Ottawa.

The Board's report contains forty-two recommendations stressing Land Use and Management and Emergency Preparedness as the primary means to alleviate adverse impacts from water level fluctuations in the Great Lakes-St. Lawrence River Basin.

Lake regulation plans for system-wide lakes regulation at plus or minus one-foot around the long-term (1900-1990) mean levels were found to be engineeringly feasible, but economically and environmentally unacceptable. Other regulation plans were developed for 3-lakes (Superior, Erie, and Ontario) regulation. These plans were also not economically or environmentally justified. Copies of the report are expected to be available by late this spring. Requests for a copy of the report should be directed to the International Joint Commission, 1250 23rd Street, N.W., Suite 100, Washington, D.C. 20440-1109.



Russell L. Fuhrman
Brigadier General, U.S. Army
Commanding General and
Division Engineer

Great Lakes Basin Hydrology

Below average precipitation and net basin supplies in February and March brought some needed relief to the Great Lakes basin. The March monthly mean lake levels compared to the March long-term averages (1900-1992), show Lake Superior at average; Lakes Michigan-Huron 5 inches above average; Lake St. Clair 19 inches above average; Lake Erie 22 inches above average; and Lake Ontario 19 inches above average. Based on the above information and in anticipation of the normal spring rise, shoreline residents of Lakes St. Clair, Erie, and Ontario continue to be alerted to possible extreme lake levels. Water level setups and wave actions caused by storm conditions can often be very serious and may require residents to protect their property. Should conditions worsen, the Corps of Engineers will provide further information and advice to shoreline residents through these Update Letters.

The precipitation, water supplies, and outflows for the lakes are provided in Table 1. Precipitation data include the provisional values for the past month and the year-to-date and long-term averages. The provisional and long-term average water supplies and outflows are also shown.

Table 1
Great Lakes Hydrology[1]

PRECIPITATION (INCHES)

BASIN	MARCH				YEAR-TO-DATE			
	1993*	AVG.**	DIFF.	% OF AVG.	1993*	AVG.**	DIFF.	% OF AVG.
Superior	0.7	1.8	-1.1	39	2.9	5.2	-2.3	56
Michigan-Huron	1.2	2.2	-1.0	55	4.7	6.0	-1.3	78
Erie	2.9	2.8	0.1	104	8.8	7.3	1.5	121
Ontario	2.5	2.7	-0.2	93	8.2	7.7	0.5	106
Great Lakes	1.4	2.2	-0.8	64	5.2	6.1	-0.9	85

LAKE	MARCH WATER SUPPLIES***		MARCH OUTFLOW[3]	
	1993[2]	AVG.[4]	1993[2]	AVG.[4]
Superior	42,000	45,000	71,000	66,000
Michigan-Huron	135,000	184,000	174,000[5]	170,000
Erie	89,000	72,000	232,000[5]	193,000
Ontario	52,000	75,000	293,000	233,000

*Estimated **1900-91 Average ***Negative water supply denotes evaporation from lake exceeded runoff from local basin.

[1]Values (excluding averages) are based on preliminary computations.
[2]Cubic Feet Per Second (cfs) [3]Does not include diversions [4]1900-89 Average (cfs)
[5]Reflects effects of ice/weed retardation in the connecting channels.

For Great Lakes basin technical assistance or information, please contact one of the following Corps of Engineers District Offices:

For NY, PA, and OH:
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For IL and IN:
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